CENTER FOR BEAM PHYSICS SPECIAL SEMINAR

"Particle-in-Cell Simulations of Electron-Impact and Tunneling Ionization Effects for Beam-Plasma and Laser-Plasma Applications*"

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Wednesday January 8, 2003, 10:30 AM
Albert Ghiorso Conference Room (71-264), LBNL

Abstract: Laser-driven (LWFA) and beam-driven (PWFA) plasma accelerators can sustain electron plasma waves with longitudinal electric fields on the order of the nonrelativistic wave breaking field, which is routinely of order 100 GV/m in table-top LWFA experiments. The laser pulse can create its own plasma from a gas jet via field-induced tunneling ionization of the neutral atoms, which leads to blue-shifting at the leading edge of the pulse, as well as steepening due to pump depletion and other effects. Tunneling ionization is also a critical issue for some proposed PWFA experiments, with gradients exceeding 5 GV/m. In addition, electron impact ionization can lead to important effects like particle trapping in PWFA concepts. We will present simulation results from the particle-in-cell code OOPIC [D.L. Bruhwiler et al., Phys. Rev. S.T. A&B, Issue 10 (2001)], which demonstrate the physical effects of these ionization processes in a few interesting cases, including detailed comparison with experiments from the l'OASIS lab at LBNL [W.P. Leemans et al., Phys. Plasmas 8, 2510 (2001)] and a brief discussion of the algorithms.

Biographical data and research interests: David Bruhwiler has more than 15 years of experience in the analysis and computer simulation of beam and plasma systems. He completed his PhD thesis work in 1990 with Prof. John Cary at the University of Colorado. David spent 6 years with the Advanced Energy Systems group of Northrop Grumman, modeling S-band photocathode guns and beamlines for generating sub-picosecond electron bunches, as well as high-intensity proton and deuterium linacs and transport lines. David has been with Tech-X Corp. of Boulder, Colorado since 1997, where he is developing parallel C++ codes for simulating plasma-based accelerator concepts. David is the PI at Tech-X for the Accelerator SciDAC project being led by Rob Ryne and Kwok Ko.

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